

North Carolina Legislative Commission on Global Climate Change: Science Panel

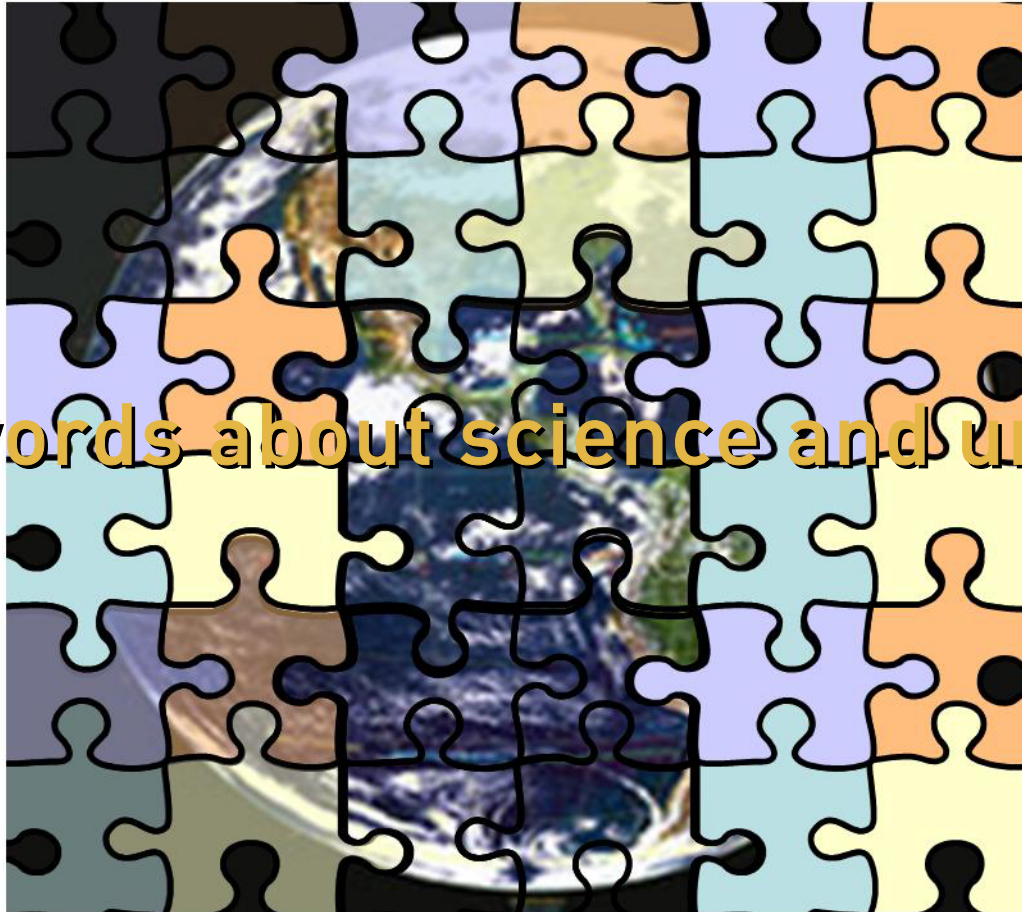
April 4, 2006

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Chief Scientist

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ENVIRONMENTAL DEFENSE

finding the ways that work



A few words about science and uncertainty

There is a clear scientific consensus

- U.S. National Academy of Sciences

- “Greenhouse gases are accumulating in the Earth’s atmosphere

“The National Academy is the gold standard of independent scientific review.”

White House Spokesperson, January, 2005

- “We urge all nations ... to take prompt action to reduce the causes of climate change.” June, 2005

There is a clear scientific consensus

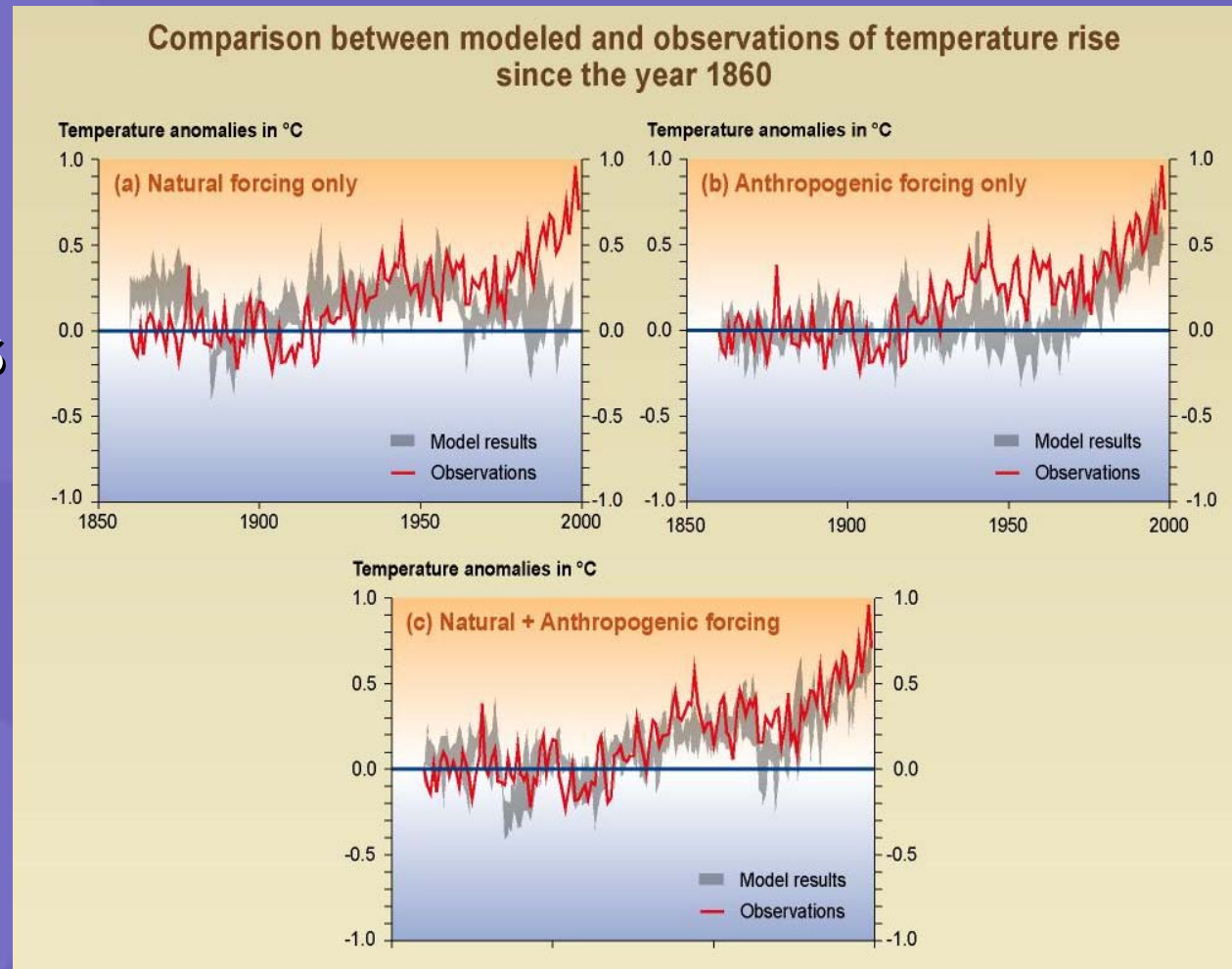
- U.S. National Academy of Sciences
 - “Greenhouse gases are accumulating in the Earth’s atmosphere as a result of human activities, causing surface air temperatures ... to rise.” NRC, 2001
 - “We urge all nations ... to take prompt action to reduce the causes of climate change.” June, 2005

THE SCIENTIFIC FOUNDATION FOR ACTION

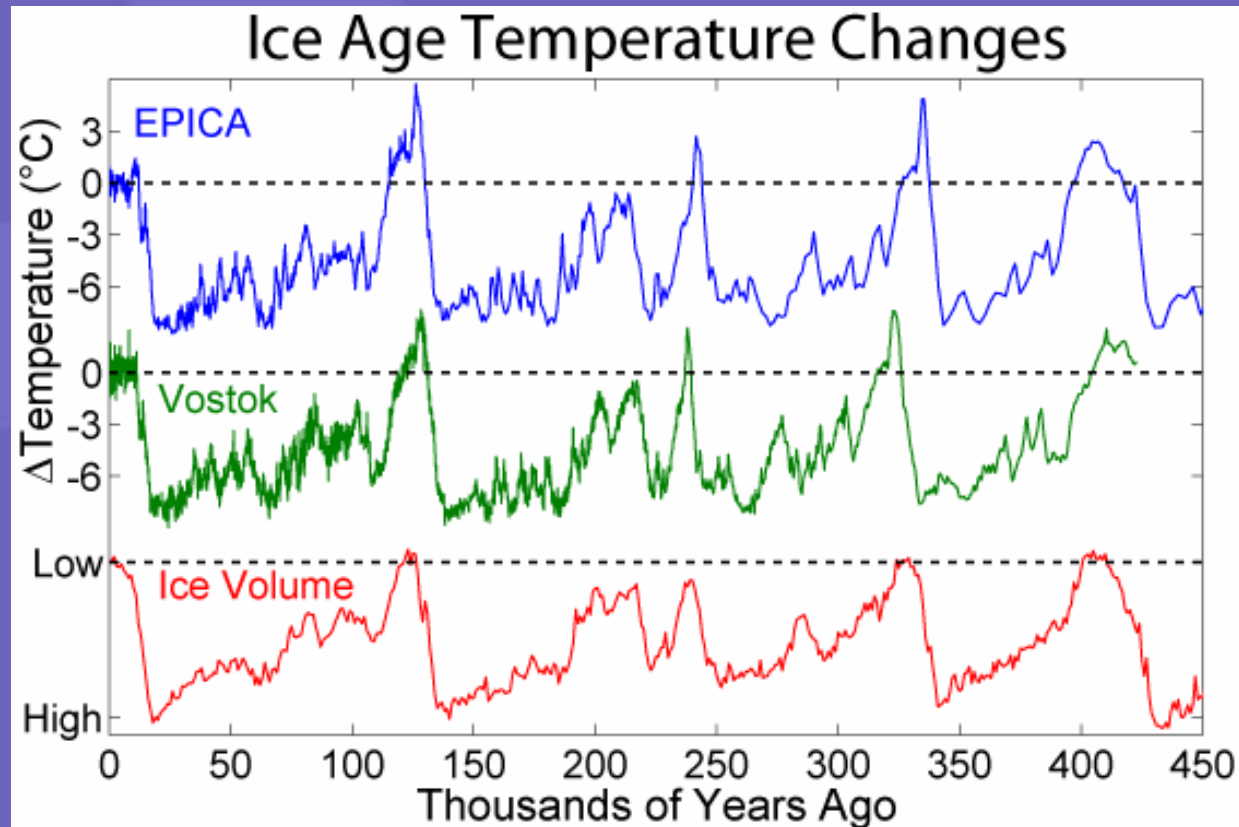
- CO₂ warms the Earth
- CO₂ concentrations are increasing because of human activities
- The globe is warming
- **Warming can be attributed to “human-emitted” CO₂ and other GHGs**
- Future warming and impacts depend on future emissions of CO₂ and other GHGs
- **Technologies needed to take first steps are in hand**

Attribution: Climate models tell us ...

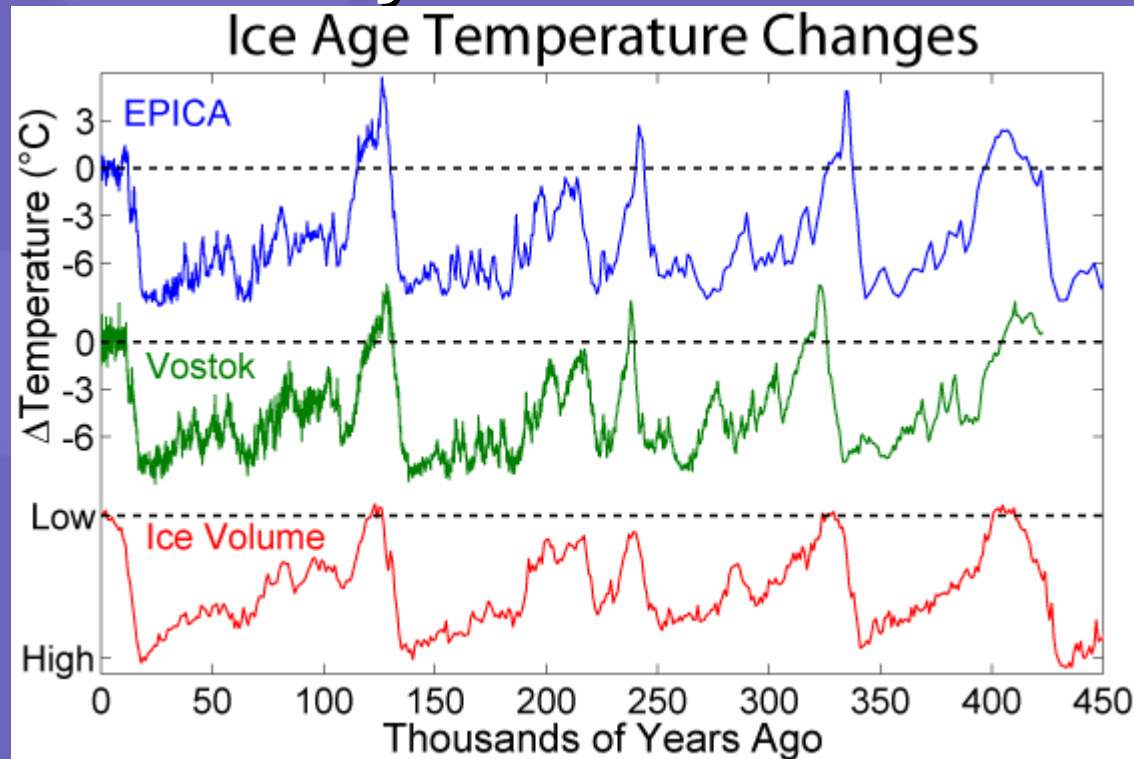
- Enhanced greenhouse effect provides the only quantitative explanation
- But there's more ...



While climate change is the rule, not the exception...



...we have a good idea what caused most major climate shift.

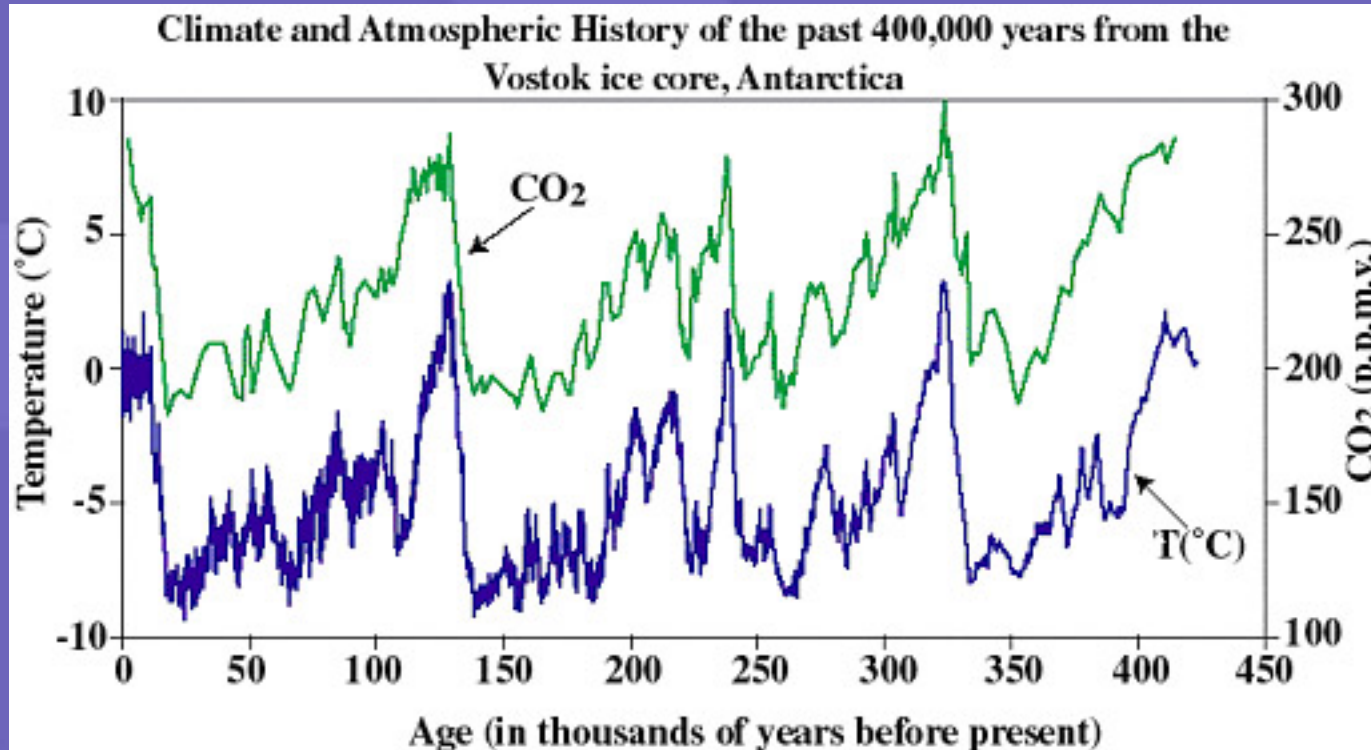


These temperature variations were triggered by variations in earth's orbit about the sun

...and carbon dioxide played a major amplifying role.

**CO₂ today:
380 ppmv!**

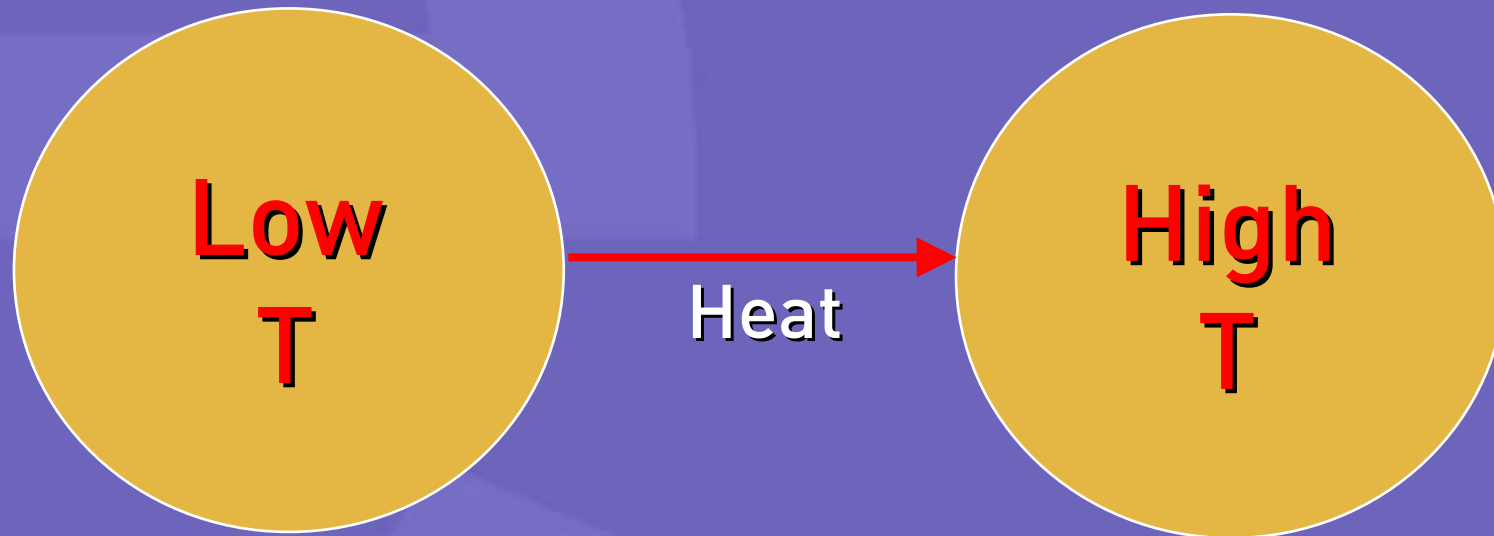
**And we know
from isotope
data that
modern
increase in
CO₂ is from
human
emissions**



Worrying implication: There are positive feedbacks in system that will amplify cause of current warning.

Any explanation of warming must have a physical basis:

Global warming requires a source of heat

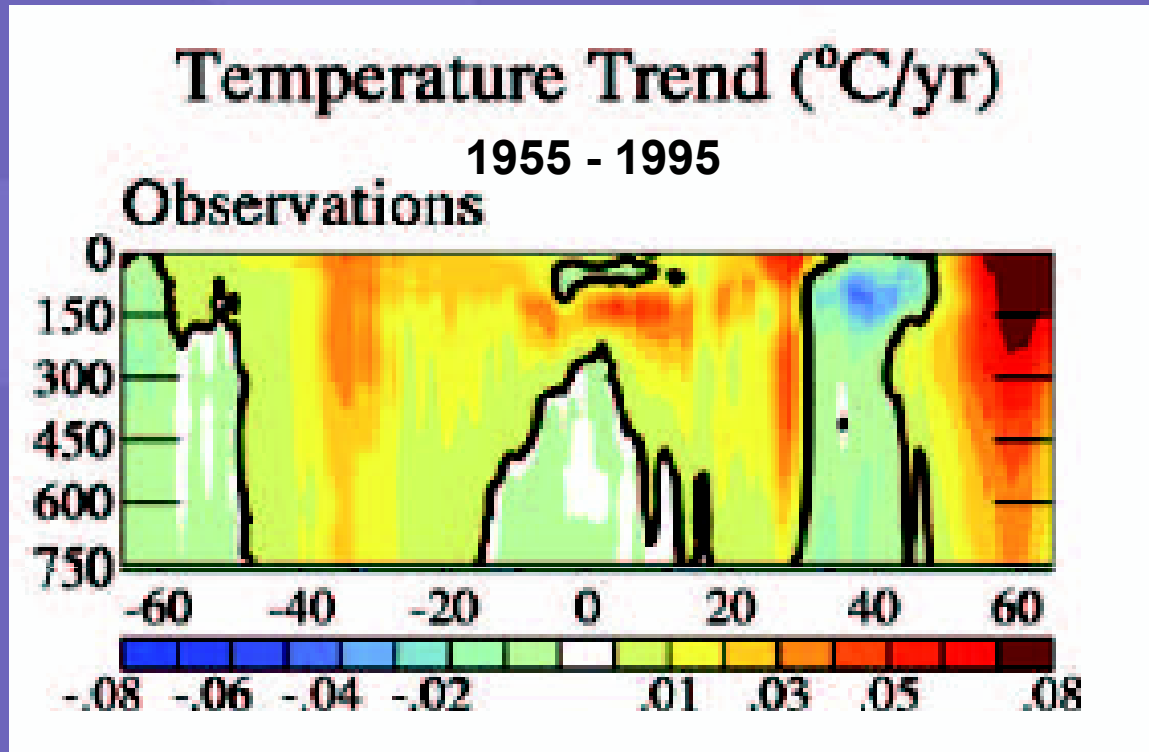


Warming Requires a Source of Heat

- The possible sources are
 - Greenhouse Effect ✓
 - Increased solar output X (small contribution)
 - Decreasing Planetary Reflectivity X
 - Internal variations – Heat from oceans X

Oceans have heated up!

- About 85% of heat from GHGs has gone to oceans



After Hansen et al. 2005 and based on
analysis of Levitas et al. 1999

And we are approaching dangerous tipping points.

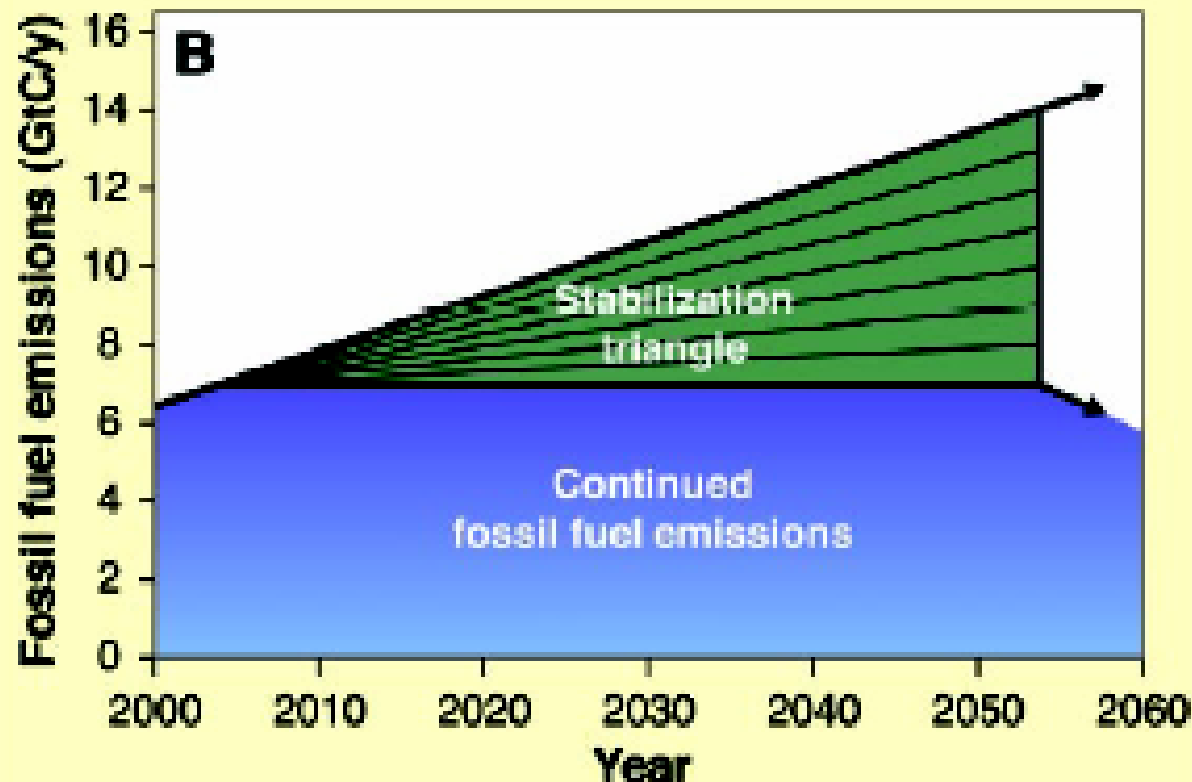
For example:

If we fail to act we could pass a threshold in as little as 30 years that will commit the world to the melting of the Greenland ice sheet and a 20 foot increase in sea level.



Pacala and Socolow formula:

Avoid dangerous climate change through mid-century using ~ 7 of 15 existing technological/policy “wedges.”

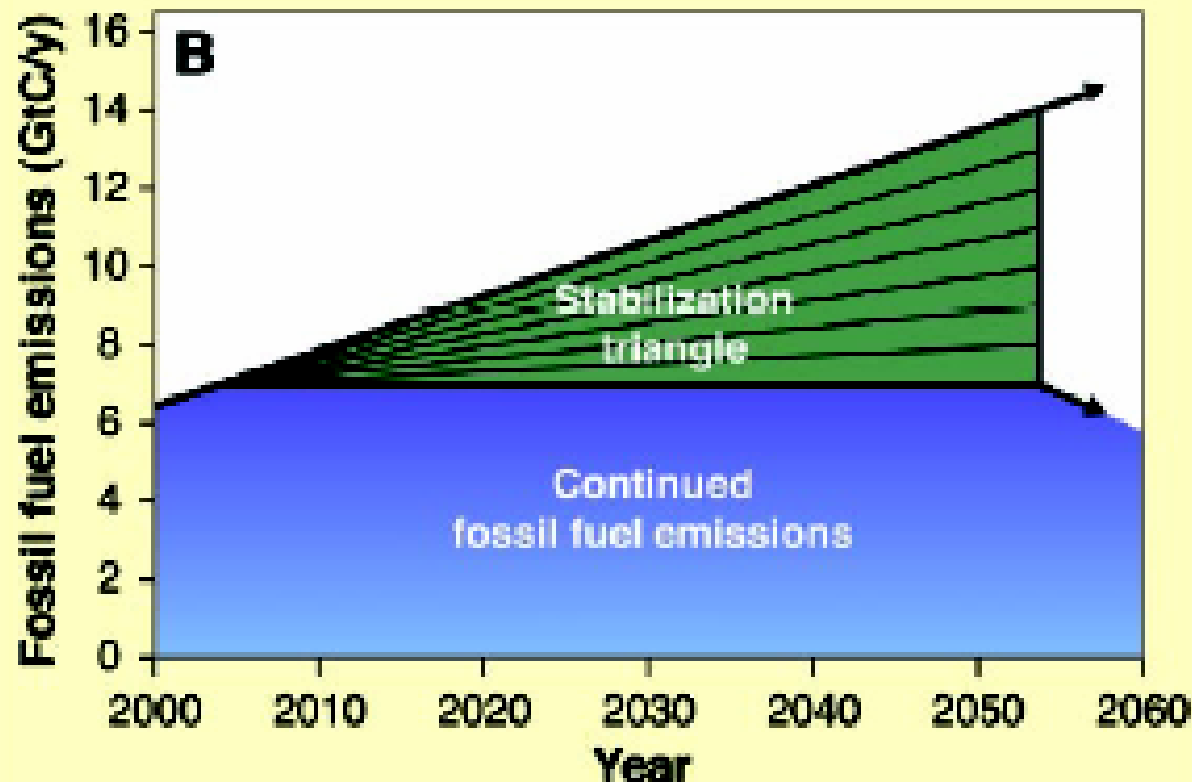


Wedges include:

- Conservation
- Efficiency
- Renewables
- Bioenergy
- Nuclear
- Clean coal with sequestration

Pacala and Socolow formula:

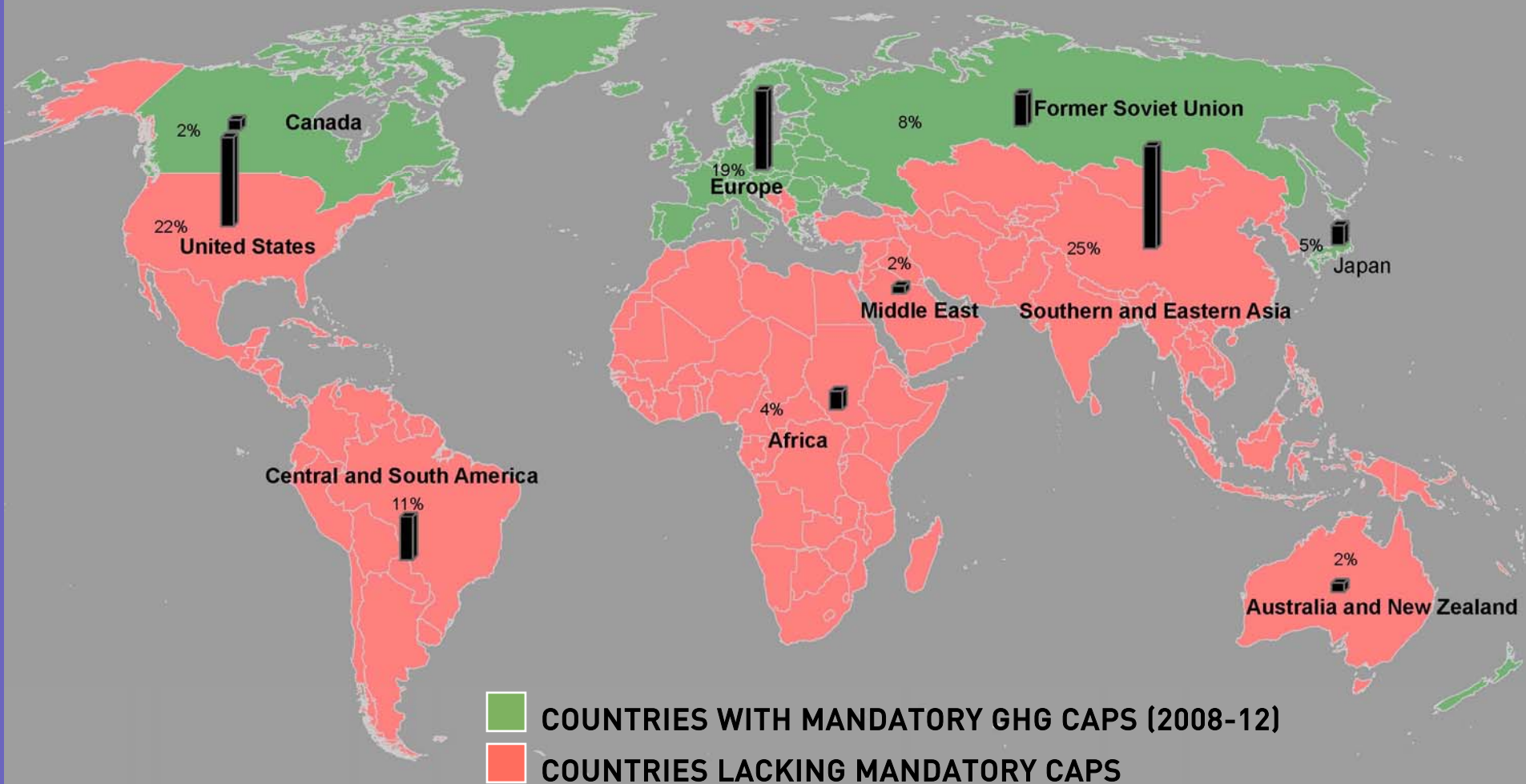
Avoid dangerous climate change through mid-century using ~ 7 of 15 existing technological/policy “wedges.”



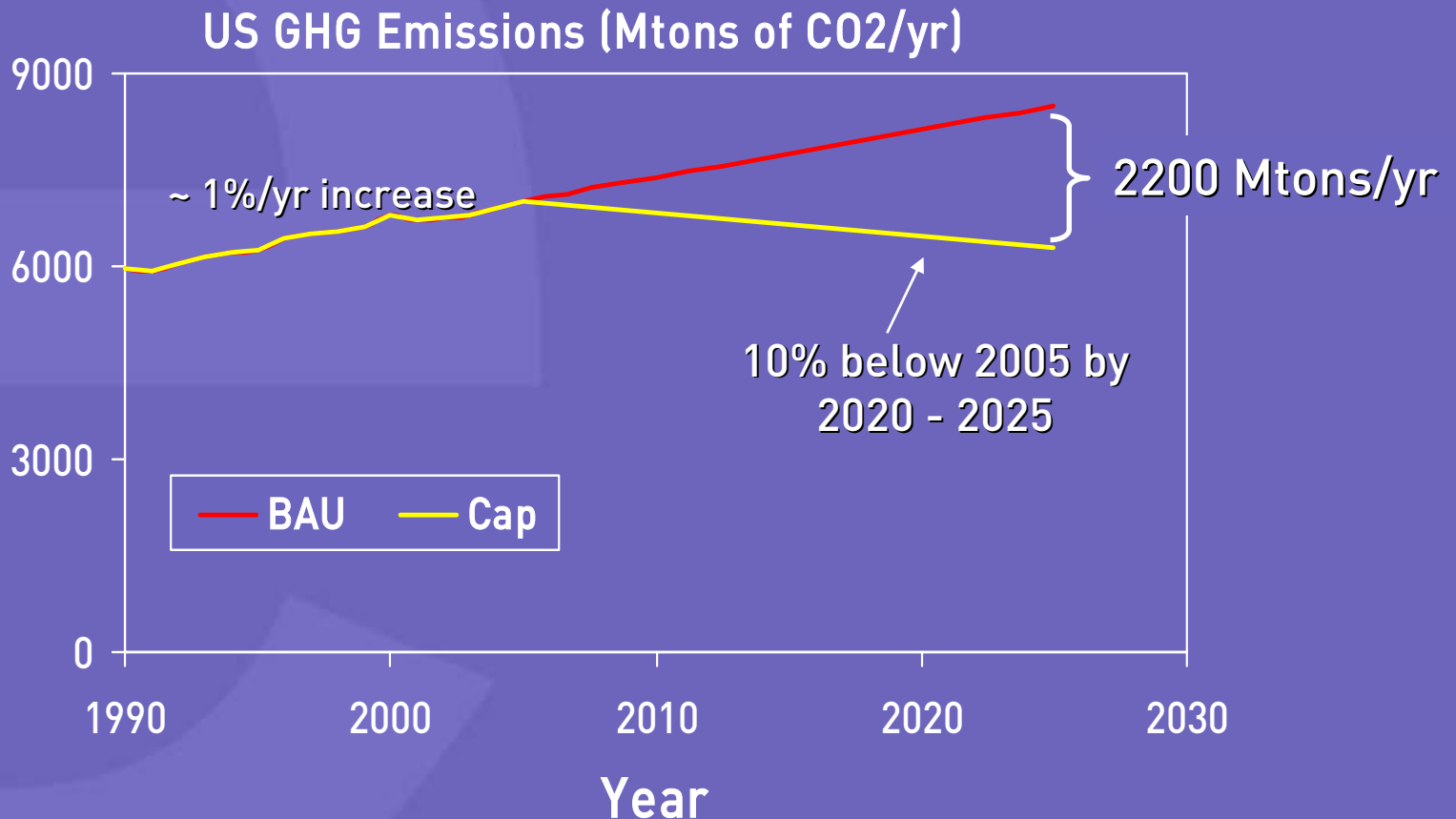
Market-based, cap-and-trade system probably the most efficient way to allow these wedges to compete and provide the most cost-effective emission cuts.

US needs to do its part...

GREENHOUSE GAS EMISSIONS - 2006



What does this mean for US in the next 10 – 15 years?



Is it possible to cut US emissions by 2000 million tons/yr?

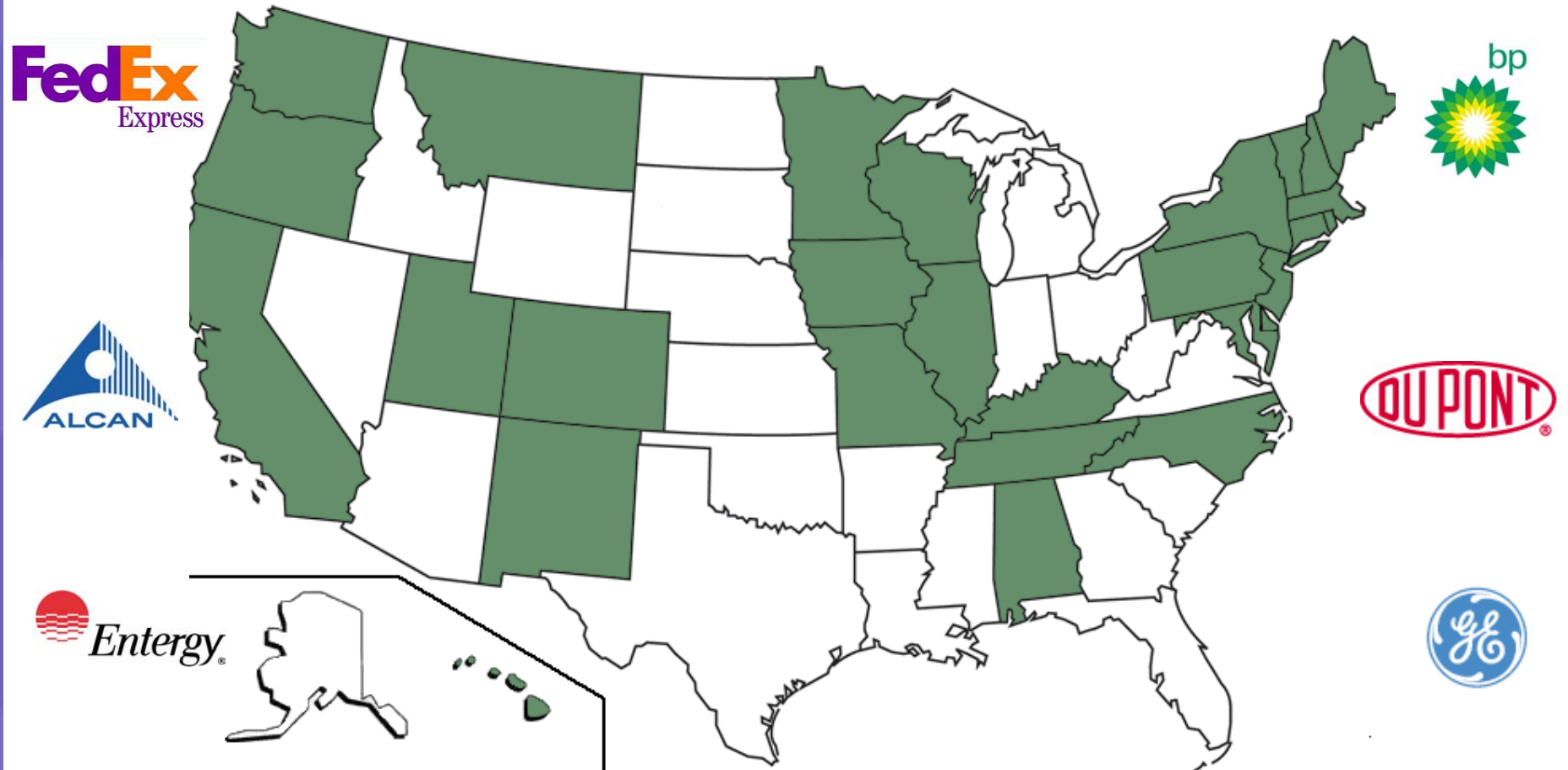
- U.S EPA: Land Management Practices
 - At \$15/ton: cut 1500 million tons/yr by 2025
 - At \$50/ton: cut 2000 million tons/yr by 2025
- Lawrence Berkeley Laboratory: Efficiency
 - At \$50/ton: cut 2000 million tons/yr

America is moving forward on global warming:

US Senate, 2005:

“It is the sense of the Senate that Congress should enact a comprehensive and effective national program of mandatory, market-based limits and incentives on emissions of greenhouse gases.”

America is moving forward on global warming:



ALL STATES TAKING ACTION PLUS 212 CITIES AND CORPORATE PARTNERS

GLOBAL WARMING SCIENCE